

CHANGES IN ALERTNESS AND PERFORMANCE OVER TIME DURING LONG-HAUL FLYING ACROSS MULTIPLE TIME ZONES

LUCIA ARSINTESCU MD MA
SAN JOSE STATE UNIVERSITY
FATIGUE COUNTERMEASURES LABORATORY
NASA AMES RESEARCH CENTER

ARSINTESCU L, HILDITCH CJ, KATO KH, GREGORY, KB, & FLYNN-EVANS EE

INTRODUCTION

- Long-haul pilots experience high levels of fatigue and circadian disruptions due to long work hours and flying over multiple time zones
- The aim of this study was to describe changes in alertness and performance among flight crews during long-haul flights crossing multiple time zones

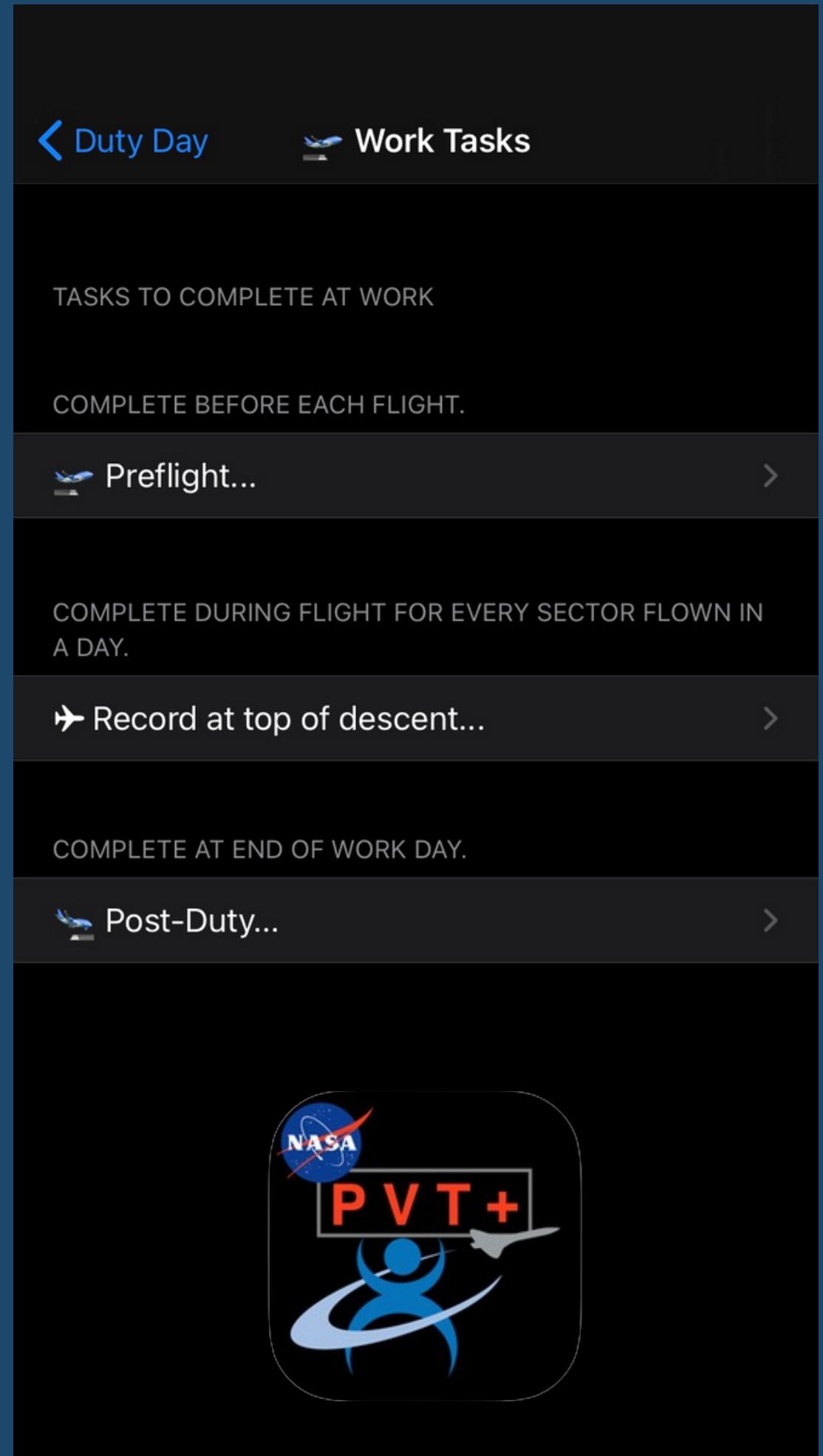
METHODS

- All pilots flying long-haul operations from a single airline were eligible to participate
- All participants collected data for ~2 weeks of their normal work schedule within airline operations, with at least two long-haul rotations, including rest days and layovers
- Each participant was provided with an iPod preloaded with the NASA PVT+ application for completing the study requirements

METHODS

Each participant completed the following data during pre-flight, on top-of-descent (TOD - inflight) and at the end of each flight (post-flight)

- a 5-min Psychomotor Vigilance Task (PVT)
- a Karolinska Sleepiness Scale (KSS)



The image shows a mobile application interface with a dark theme. At the top, there is a navigation bar with a left arrow, the text 'Duty Day', and a right arrow. Next to it is a 'Work Tasks' section with a small airplane icon. Below this is a section titled 'TASKS TO COMPLETE AT WORK' with the sub-instruction 'COMPLETE BEFORE EACH FLIGHT.' A task item 'Preflight...' is listed, featuring a small airplane icon and a right arrow. Below this is another section with the sub-instruction 'COMPLETE DURING FLIGHT FOR EVERY SECTOR FLOWN IN A DAY.' A task item 'Record at top of descent...' is listed, featuring a small airplane icon and a right arrow. At the bottom, there is a section with the sub-instruction 'COMPLETE AT END OF WORK DAY.' A task item 'Post-Duty...' is listed, featuring a small airplane icon and a right arrow. In the bottom right corner of the screen, there is a circular logo containing the NASA logo, the text 'PVT+', and a stylized blue human figure.

PARTICIPANTS

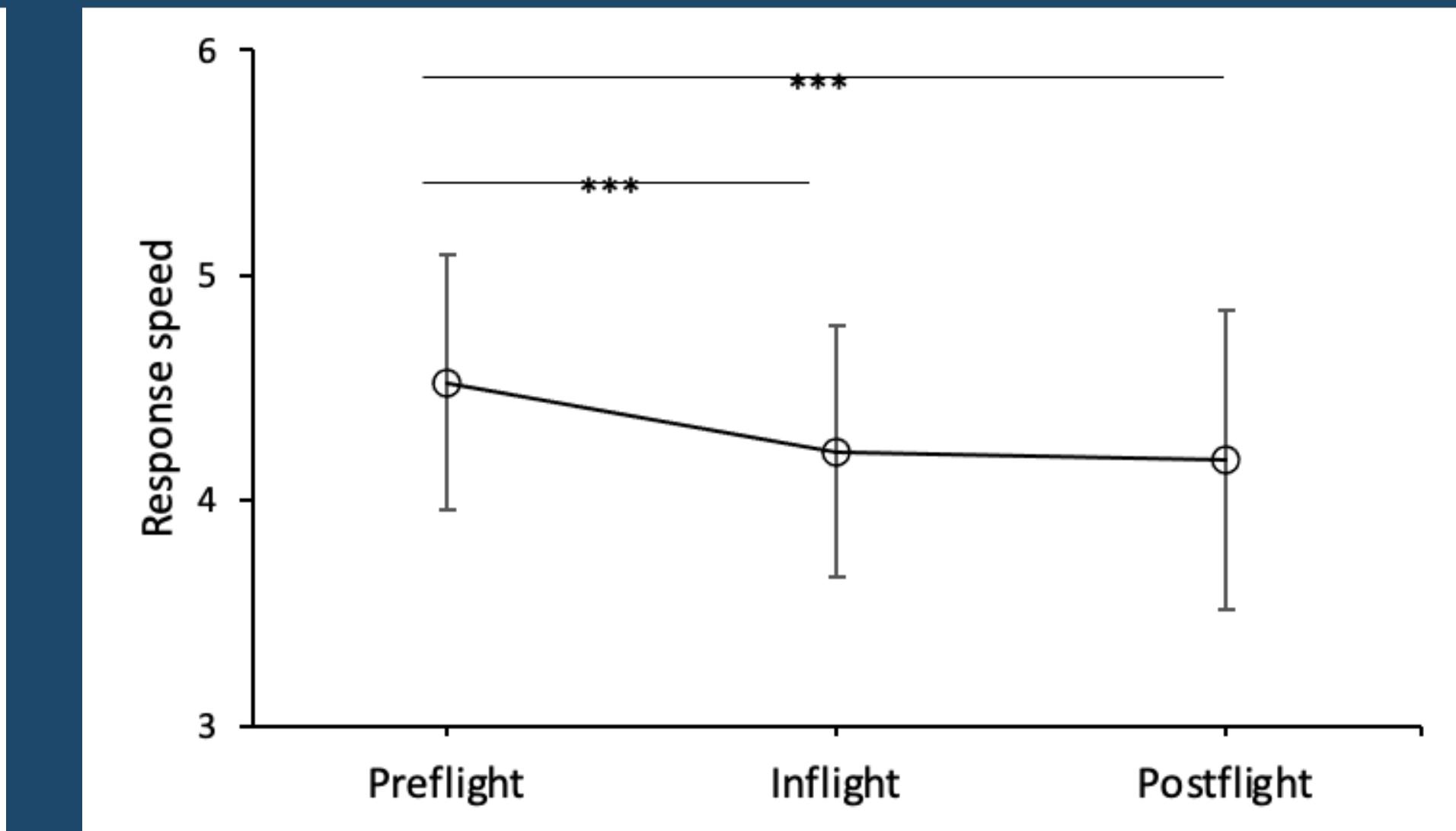
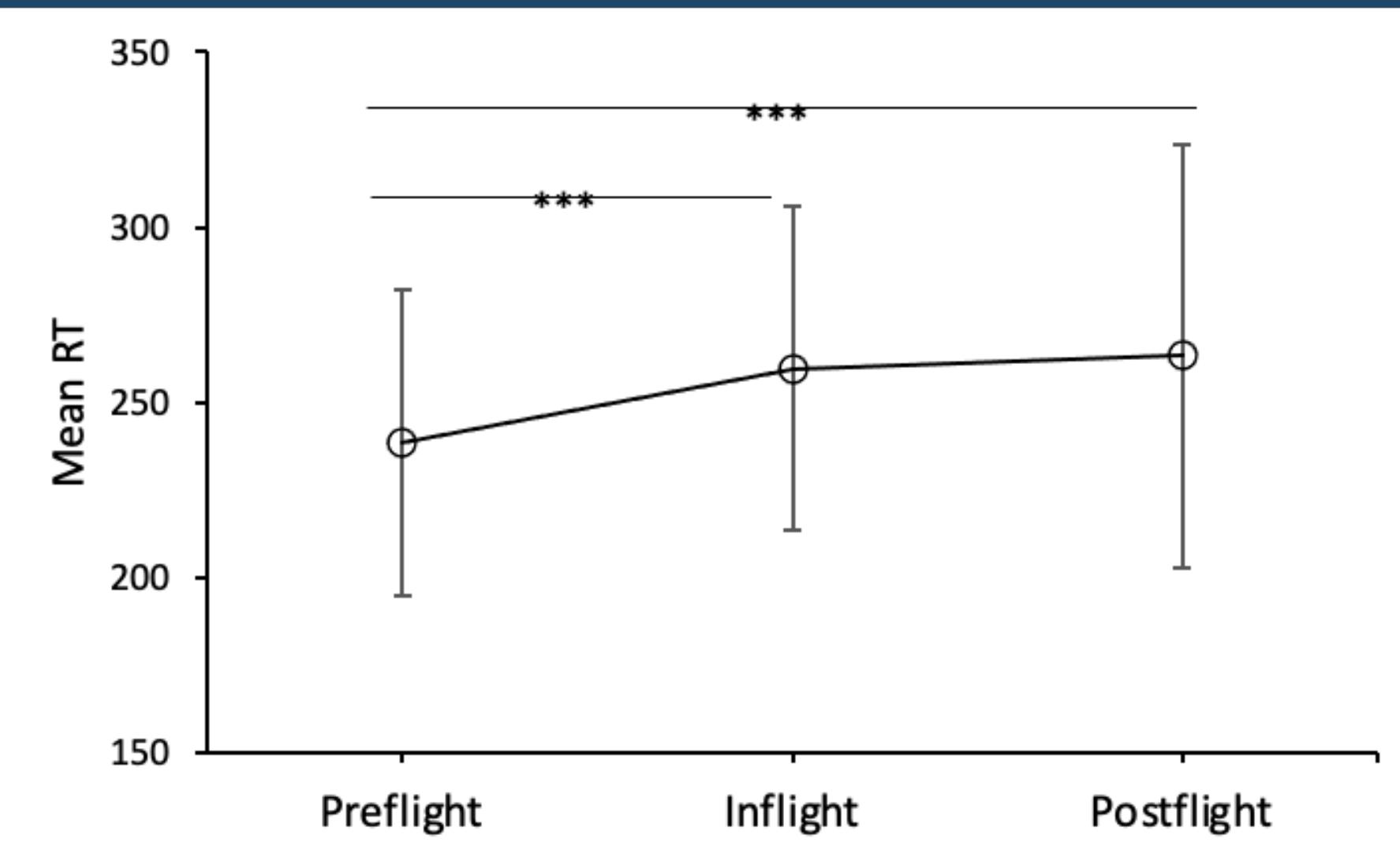
n = 44 (4 females)

Mean +/- SD

Age	44 (10)
Height (cm)	181.5 (7.7)
Weight (kg)	81.5 (11.3)
BMI (kg/m ²)	24.1 (2.5)
Self-reported sleep need (h)	7.7 (0.8)
Most alert time of day	11:05 (03:39)
Most tired time of day	14:09 (07:19)
Total commercial hours	9834.3 (5334.1)
Total hours on type	2833.0 (2141.1)
Total hours with current airline	9235.5 (5028.0)

cm = centimeters; kg = kilograms; BMI = body mass index; kg/m² = kilograms per meter squared; h = hours

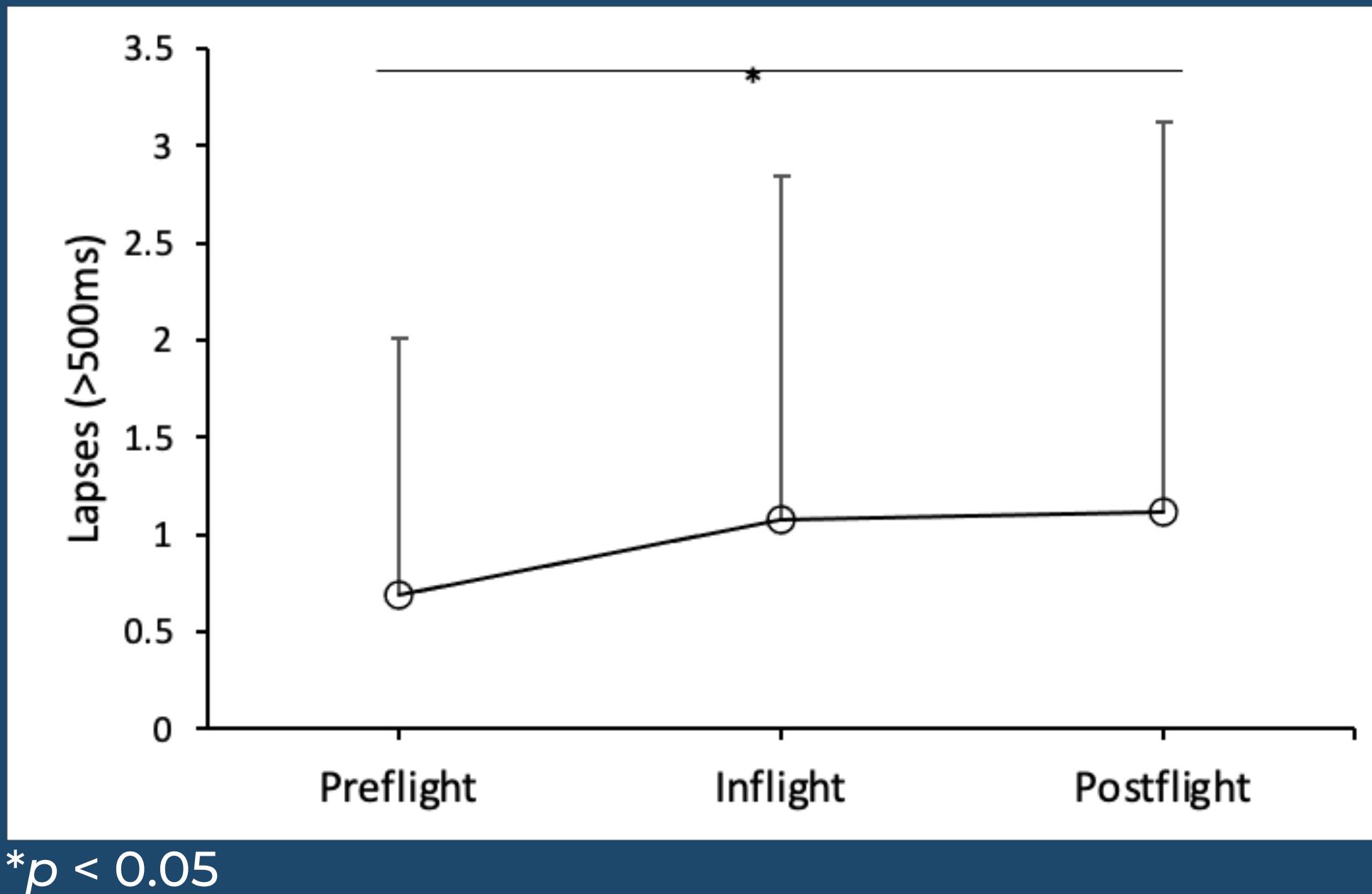
RESULTS - PVT



*** $p < 0.001$

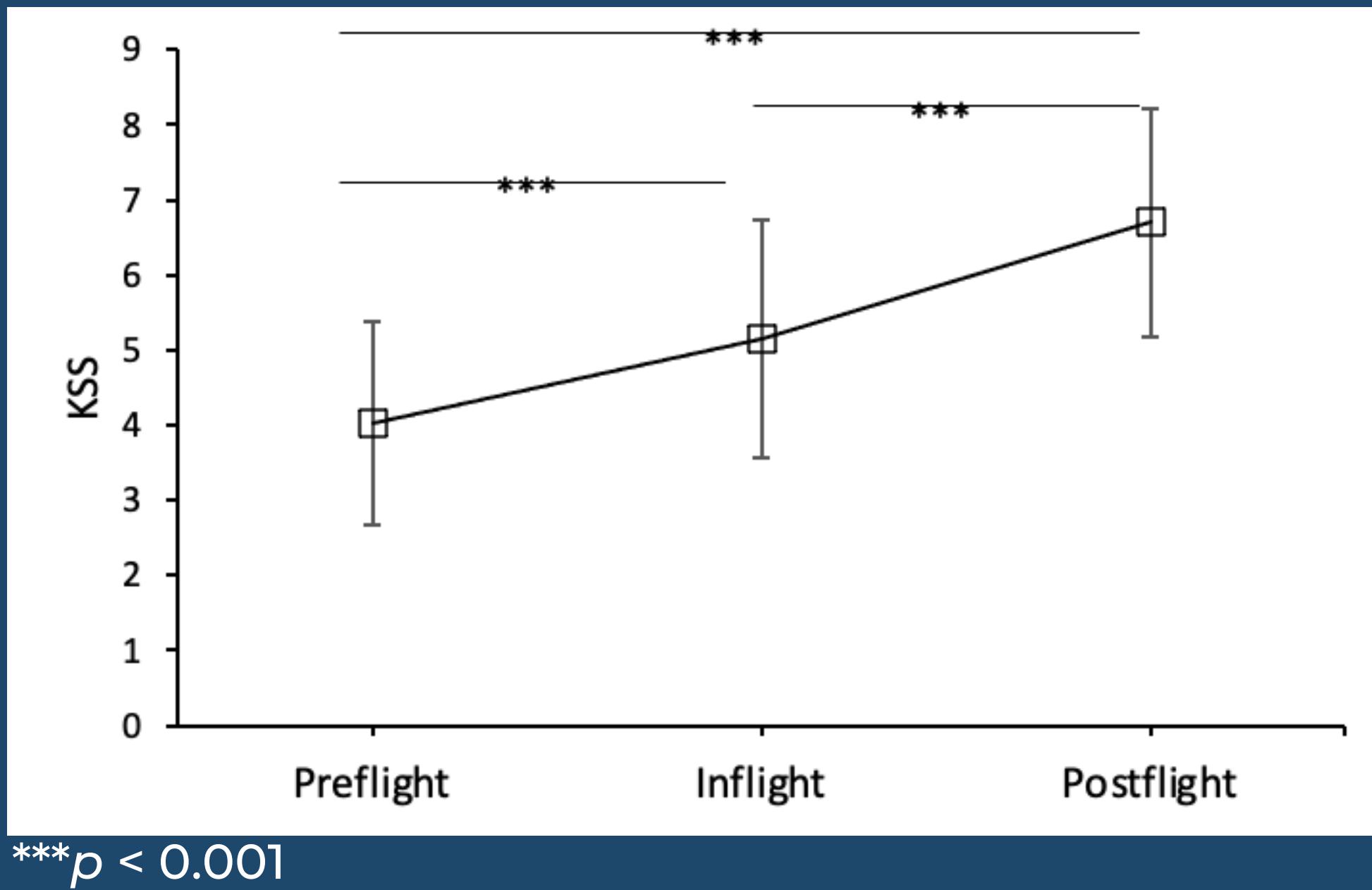
- Mean RT (Mean Reaction time): worse performance post-flight and inflight relative to pre-flight
- Response speed (1/RTx1000): slower speed inflight and post-flight relative to pre-flight

RESULTS - PVT



- Lapses (RT > 500ms) increased post-flight relative to pre-flight

RESULTS - KSS



- Participants reported as being more sleepy inflight relative to pre-flight and post-flight relative to inflight and pre-flight

CONCLUSIONS

- Performance as measured by PVT was worse at the end of the flight compared to the beginning of the flight. Participants made more lapses at the end of the flight.
- Participants reported as being sleepier at the end of the flight relative to inflight and begining of the flight.
- We thank to the airline staff and participating pilots

email:
lucia.arsintescu-1@nasa.gov

